

# Study & Analysis of Water Urification based on Solar System

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**Abstract**—Water quality is an important issue in everyday life. We have designed economical and robust system that can check water grade and update organization on water condition. Consumption of untreated industrial Water exposes human beings to a range of contaminants Including faecal borne pathogens and chemical pollutants. But the quality of water should be such that it can be used by human being for drinking purpose. There are already Lot of filters present in the market that can-do purifying Process, as the available filters made water safe to drink, water quality measurement using GPRS and web based monitoring and is proposed to control water pollution and human diagnosis due to the water pollution. Solar panel is used to save the electricity. The different sensors are used to measure the different parameters of the water. The standard values of the parameters stored in database are compared with the measured values. If measured values are not approximately equal to standard values then, the quality of water does not meet the requirement.

**Keywords**—IOT Drinking Water, RO, Solar power, Total Dissolved Solids (TDS), Water Purification.

## I. INTRODUCTION

Currently drinking water faces many challenges in the current situation due to growing population and pollutants from industries, agriculture waste etc., are mixed with drinking water. Traditional methods of testing drinking water quality parameters like, turbidity, pH, conductivity and temperature etc., may consume time because samples are tested manually in the laboratory. To overcome this, in our paper we are proposing smart and low cost system for real time monitoring of water quality by using ARM 7, which provides global testing. The parameters considered to test quality are Temperature, Turbidity, pH, Conductivity. Sensors immersed into sampled water measure the parameters. The sensed data is sent to the ARM7 LPC2148. Through GPRS Module data is sent to web server. The sensed data parameters are compared with the standard values which already exist in ARM7 LPC2148. The data stored in ARM7LPC2148 is accessed from the Web server. If there is any discrimination then we get a mail through INTERNET.

## II. OBJECTIVES

- 1) The aim of this project is to purify water by using solar energy.
- 2) To provide benefits in the rural areas where amount of energy is not sufficient.
- 3) To eliminate bacteria, and to remove turbidity, has strong potentials to remove other common surface and groundwater pollutants.

## III. METHODOLOGY

- The water purification and disinfection system is divided into two steps.
- First is the compact filter preparation and second is the solar collector preparation.
- In this system, the water is filtered by using physical process of filtration as well as solar energy.
- At first the water is filtered by using the compact water filtration.
- Then the pure water is reserved in an aluminium cylinder surrounding with the square glass, which is connected with the solar flat plate solar collector.
- The solar collector consists of aluminium cane that absorbs the solar heat energy and passes through the aluminium cylindrical chamber.
- The solar collector is an air tight chamber in which glass is used as surface cover.
- Then the reserve chamber obtained heat either directly from the sun or the solar collector so that no significant effect on the disinfection of E. coli bacteria.
- From this, some condensed water is collected from the reservoir which is considered as pure water.
- There are many parameters of measuring water are tested by different instruments after and before treatment.
- Finally we the pure drinking water.

This step includes decision associated with material production process and specification selection. Some critical decisions are specification of solar panel battery and heating coil. This information defines the charging time of battery by solar panel and time to increase water temperature by heating coil.

In solar water purifier. 12 V solar panel is used. Battery capacity is 12 V and voltage is 12 V. A 200 watt AC heating coil is used to boil water. Final design of solar water purifier is done by SolidWorks and presented in figure.

In this water purifier, at first impure water is given in the first vessel which contains filtering column. After filtration, water flows to second vessel where water temperature is rise to 85°C with a heating coil. Then, water at 85°C flows through double layer condenser and temperature of output water as 15 C-40°C. Finally, water at room temperature is stored in third vessel from where pure drinking water can be consumed.

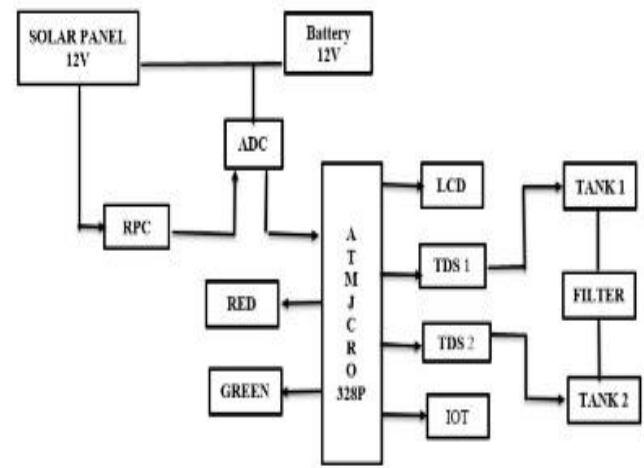


Fig. 1. Block Diagram for System

## IV. BLOCK DIAGRAM , CONSTRUCTION and WORKING

Construction of a product is the trickiest part of developing a product.

- The tubes have special rearing to absorb maximum sunlight They are like a thermos flask with vacuum between outer and inner tube Non- potable water is filled in the tubes after filtering with four-layered cotton cloth. The water gets heated in the stagnation made by solar energy, making it potable When the sun shines onto a solo panel, energy from the sunlight is absorbed by the PV cells m the panel. This energy creates electrical charges dial move in response to au thermal electrical field to the cell causing electricity to flow
- There are several methods used in the water purification process which include (1) physical processes, such as filtration, sedimentation or distillation: (2) biological processes, such as sand filters active carbon; (3) chemical processes, such as flocculation, chlorination the ne of ultraviolet light
- water systems often use a series of water treatment steps that include coagulation flocculation, sedimentation, filtration, and disinfection .



Fig.2. Setup

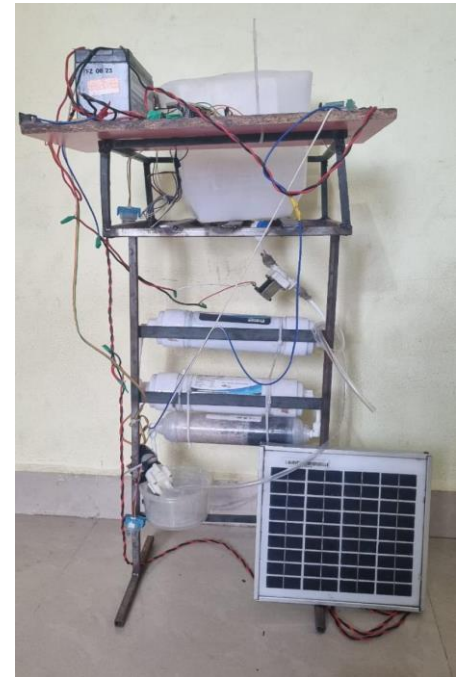


Fig.3 Model

## V. COMPONENTS

1. **Solar panel** : In ins paper, solar energy is being collected by using a solar panel. The collected solar mingy is beg stored in the battery. In case of rural and remote areas and the areas affected but natural disasters where electricity as a bag problem, this stored energy can be used for the purification of water. The charge controller used here controls the required amount of solar energy to be stored in the battery.
2. **Battery**: The battery is being charged by the solar panel. The solar panel produced voltage in the form of direct current (de) a12V de battery is common and easy to find so it is selected for this system. Two batteries are used in system Battery is connected to purification unit through relay.
3. **Charge controller**: It is protective device. Charge controller prevents battery from getting battery from overcharge. This improves the battery performance and life span. Voltage rating of charge controller

should not be greater than solar panel voltage rating. The maximum charge holding capacity of the battery is 27.6V. A charge controller has been connected across the battery to prevent it from getting overcharged 1.5., above 27.6V.

4. **Inverter**: Inverter device which converts dc into ac the energy collected by the solar panels in the de form RO system is depend on ac supply hence it is necessary to convert it into ac by using inverter in this paper we are using cd4047 inverter IC To run AC loads this as mostly used as consumable purpose The power output of the inverter is 100W, input voltage is 12V, Output is 220 V, and 50Hz square wave output. [3]
5. **Sensors**: TD5(total dissolved solvent) water level sensor and relays TDS sensor indicates the total dissolved solids(115) of a solution ie the concentration of dissolved solid particles. Water Level are used to detect the level of water.
6. **Booster Pump**: Booster pump is used to increase the pressure of water In normal condition osmotic pressure is higher For the purify Contraction of a product is the trickiest part of developig a product. This step includes decision associated with material, production process and specification selection Some entice decisions are specification of solar panel battery and heating coil This information defines the charging time of heating bysolar panel and time to increase water temperature by heating coil.
7. **Filter Kit**: Sediment filter ,Pre carbon filter ,Post carbon filter ,TDS controller ,Overflow switch
8. **LCD LIQUID CRYSTEL DISPLAY**: LCD stands for Liquid Crystal Display 1.4.Dis finding wide spread use replacing LEDs (seven segment: LEDs or other multi segment LEDs) because of the following reasons
  1. The declining prices of LCDs.

2.The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.

3. Incorporation of a refreshing controller to the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data .

4. Ease of programming for characters and graphics.

These components are "specialized" for used ein with the Atme a 2rs, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD-44780

Atmega328 (Hitachi and can display messages m two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own. Automatic shifting message on display (shift left and right), appearance of the pouter, backlight etc. are considered as useful characteristics.

9. **RCP (Reverse charge Protection)**:The invention discloses a solar charging and a charging protection system. A solar charging input end is connected with an input voltage detection module, a charging voltage detection module and a charging current detection module. A load output end is connected with a load voltage detection module and a load current detection module. A storage battery is connected with a battery voltage sampling module. The input voltage detection module, the charging voltage detection module, the charging current detection module, the load voltage detection module, the load current detection module and the battery voltage sampling module are connected with the signal input end of an MCU The signal output end of the MCU is in control connection with a charging voltage control module, a charging current control module, a discharging voltage control module and a discharging overcurrent protection module. The



MCU is further connected with a charging time setting module. By means of the solar charging and reverse charging protection system, a solar panel can be controlled to charge the storage battery, and the storage battery cannot conduct reverse charging on the solar panel. It is a protective device. Charge controller prevents battery from getting overcharged. This improves the battery performance and life span. Voltage rating of charge controller should not be greater than solar panel voltage rating. The maximum charge holding capacity of the battery is 6 A. A charge controller has been connected across the battery to prevent it from getting overcharged above 27.6V.

## VI. HARDWARE USED

### A. Microcontroller LPC 2148

LPC2148 is a development platform based on LPC2148 ARM7TDMI microcontroller which is powerful and with 512K onchip memory. This board does not need external power supply, it is powered by USB port [7]. For applications involving high speed wireless communication (WiFi / Bluetooth / Zigbee), real time data monitoring, USB based data logging and interactive control panels, this development board is ideal [8]. With direct high speed interface to a PC/laptop with on-chip USB controller provides speeds up to 12Mb/s. The UART boot loader allows you to program using serial port and eliminates need of an additional programmer. SD/MMC card interface, USB2.0 interface, Xbee / Bluetooth / WiFi wireless module interface, 4Kbit 12C EEPROM, L293d DC motor controller are some of the on board peripherals.

### B. MAX 232 Board and GPRS Module SIM 800L

The signals from RS232 serial port are converted to proper TTL signals which are digital logic circuits by this integrated circuit. It can convert signals like CTS, RTS, TX and RX and it is also a dual driver/receiver. The driver increases the output voltage levels of TIA232 from a 5 volt supply to 7.5 volts by using the external capacitor and on chip charge pumps. The receiver reduces the input levels from 25 volts to the standard voltage level, i.e. 5volts of TTL levels and there is a threshold of 1.3 volts and hysteresis of 0.5 volts for the receiver. Further the max232 IC is extended

with receivers and transmitters to give MAX238 and MAX248 and there are many combinations of such receivers and transmitters. A SMT type solution Quad-band GPRS/GSM is SIM800 which can be embedded in consumer applications. It supports 850/900/1800/1900 MHz Quadband on which it can transmit data information, SMS and Voice with negligible power consumption. Due to its tiny size (24\*24\*3mm), it can provide to compact demands of customer and fit into slim slots. It allows total cost savings and fast time-to-market for customer applications featuring Bluetooth and Zigbee.

### C. Sensors

**1) Turbidity Sensor TSD-10:** The turbidity in wash water and washing machines is measured by TSD-10 module. Using the refraction of wavelength between photo transistor and diode, the optical sensor measures turbid water density or extraneous matter concentration for washing machine. An optical washing machine sensor measures the amount of light coming from source to destination in order to calculate turbidity of water using optical diodes and transistors. The amount of light passing through the sample is inversely proportional to amount of soil in water is the principle on which the sensor operates. Amount of light decreases as the amount of soil in water increases. To determine the turbidity of wash water, the turbidity sensor measures the amount of light transmitted through the sample.

**2) Temperature Sensor LM-35:** LM35 series are temperature sensors integrated circuit which gives output voltage linear to the Celsius (Centigrade) temperature. It has an advantage over temperature sensors calibrated in Kelvin, as manual subtraction of a constant from its output is not required. The application of LM35 can be done in same way as other integrated circuit temperature sensors. It can be fixed or glued to a surface and temperature will be within range of about 0.01 degree of surface temperature.

**3) pH Sensor:** pH is an important parameter which indicates if the solution is acidic or basic. It has to be measured and controlled efficiently. The combination of pH sensor components in one

device is called combination pH electrode. Electrode is mostly made from fragile material like glass. Developments have been made to replace glass with more durable solid-state sensors. The analyser has a man machine interface for calibrating the sensor and configuring alarms and output, if pH control is being done.

**4) Conductivity Sensor:** A versatile tool in process control is conductivity measurement. A little maintenance is required if measurements to be measured are most advanced, simple and fast. Various assumptions on what is happening in the process can be made based on measured conductivity reading. Concentration of the liquid can be calculated in some cases by developing a model. Concentration of the liquid can be measured along with conductivity and temperature. The curves for various acids and bases that are pre-set are commercially available.

## VII. APPLICATIONS

### A. Residential Society

We know that nowadays corporations and government set their Water quality monitoring and treatment plants on water tanks. But when it comes to Residential society, it is very rare that we see monitoring system in societies. So our design is very affordable and scalable to place system in societies.

### B. Hospitals

In the Hospitals and Medical clinics it is very important to serve quality and pure water to patients and visiting people. In our design we define some parameters to check water quality like turbidity, PH it is necessary to maintain turbidity level and Ph level of water.

### C. Chemical Laboratories

In the chemical laboratories or pharmaceutical laboratories it is necessary to maintain temperature and ph value in moderate level. Hence temperature sensor will help to monitor the water temperature.

### D. Agricultural Purposes

When the water level reaches the adequate level, water level sensor will send the information to the microcontroller and makes the water pump motor

OFF [9]. The farmer can request information through GSM and get it whenever applied.

## VIII. RESULT

The system for purification of water has been built using the most accessible form of source that is alight which can be easily captured and accumulated through solar panels costing no electricity or external energy. On the other hand, the rest of the parts is playing their faction to forward the process through motor and further filtering through various filter pumps and RO membrane getting rid of not only get, algae, minerals but also unwanted bacteria viruses, etc. The design and ease to operate makes it more efficient to use as well as affordable for all.

## XI. CONCLUSION

This machine is the most convenient and accessible for the disinfection of water where power supply and ways to purify water is unmapped. The sample mechanism and integrated structure rhythmically coverts the solar energy through motor and assists the filtration process devoiding water from bacteria, minerals and other unwanted viruses giving potable water. It is expensive and uses solar energy to party abundant water, so it can be used anywhere there is no electricity. This could be an area for future research in this era. This type of Water Purifier is not yet on the market. Therefore. We believe that if solar water purifier are effectively implemented by removing limitations so they will be able to attract customer from all sector living in urban and rural areas.

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